

APPLICATION
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TITLE: MEDICAL EXAMINATION SYSTEM

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MEDICAL EXAMINATION SYSTEM

BACKGROUND OF THE INVENTION

5 1. Field of the Invention

 The present invention relates to a medical examination system that manages the order of patients waiting for a medical examination so as to minimize the time that is required from the start to the end of the medical examination of the patients in an on-site medical examination.

10 2. Discussion of the Related Art

 In a conventional medical examination system that controls the order of patients waiting for a medical examination, systems or algorithms that control waiting lines, under the presupposition that patients have already arrived at a fixed institution for a medical examination, wherein the order is set so as to optimize the order of later arriving patients waiting in line (Japanese Unexamined Patent Publication No. Hei 08 -194853) or wherein the order is indicated (Japanese Unexamined Patent Publication No. Hei 11-205337) have been proposed. These medical examination systems have configurations that cannot, as a whole, be physically moved.

Accordingly, as in the case where the patients are
presupposed to receive a medical examination during working hours
in a working office or during farm work, an appointment that
makes the amount of time of work interruption the shortest cannot
5 be achieved by minimizing the time from the start to the end of
the medical examination that is required for individual patients,
even if the starting time of the examination is delayed. In
addition, in an on-site medical examination the portability of
the entire system is required places, layouts and the order for
the medical examination cannot be set because of installment
conditions in working offices or local public offices where the
medical examination is held. Accordingly, guidance for the order
and places of medical examination that is required based on
appointment conditions cannot be given to individual patients at
15 the site of the medical examination.

Therefore, in conventional on-site medical examinations,
these conventional systems for controlling waiting time have not
been utilized. Because an appointment cannot be made for the
shortest medical examination time by grasping the medical
20 examination condition during working hours and because there is
no portability nor is there guidance given to individual patients
at the site. In most on-site medical examinations, an
orientation paper including the time precisely arranged schedule

according to an individual patient is not delivered in advance.
No proper guidance is given at the site concerning the medical
examination items or the examination site. Therefore, in many
cases, considering the time needed for the actual medical
5 examination, patients waste much time waiting after having
arrived at the examination site and, in addition, waste time at a
hastily arranged site by being confused concerning the order of
the medical examination.

SUMMARY OF THE INVENTION

The purpose of the present invention is to provide a medical
examination system that has a simple configuration and has
portability. The present invention includes a plurality of
wireless display devices that have a display part and a
15 communication part held by each patient waiting for a medical
examination.

And in the case of an on-site medical examination under the
presupposition that the patients receive a medical examination
20 during working hours, the system makes individual appointments so
that the entire medical examination time is minimized by enabling
the progress of the medical examination to be understood from the
working offices wherein business is carried out and which, even

in the case that the place, layout and the order of the medical examination has changed due to the installation conditions of the examination apparatuses, gives guidance concerning the necessary order and the place of the examination based on appointment conditions to individual patients by means of a wireless display device at the site of the medical examination so that the time of interruption of work due to the medical examination is minimized and so that the patients are not confused by the order of the medical examination at an unfamiliar site and can smoothly receive a medical examination.

Thereby, the effects are gained that allocations are sequentially confirmed from the medical examination item that can start the earliest within the range of time for which the allocations are possible and, then, based on the confirmed result the medical examination item which can start the earliest within the range of time where allocations are possible is sequentially confirmed so that the medical examination time for the entirety of the medical examination item is minimized. In addition, the effects are gained that the patients do not waste time, which tends to occur at an on-site medical examination, by being confused at a hastily prepared medical examination site.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic diagram of the entire configuration of a medical examination system according to an embodiment of the present invention;

FIG. 2 is a diagram showing a detailed configuration example of a waiting queue means 114 for individual medical examination items of a scheduler 111 shown in FIG. 1;

FIG. 3 is a diagram showing a sequence of a detailed appointment process and a configuration example utilizing a waiting queue means 115 for individual patients and a waiting queue means 114 for individual medical examination items by means of the scheduler 111 shown in FIG. 1;

FIG. 4 is a diagram showing an appointment condition of the waiting queue means 114 for medical examination items shown in FIG. 2 after a medical examination appointment of the patient idn shown in FIG. 3 is made;

FIG. 5 is a diagram showing a process method for making an appointment by shortening the medical examination time even in the case that an isolated empty id occurs due to dispersion of the medical examination time among the medical examination items;

FIG. 6 is a flow chart showing the operation of the initial process for appointments and the configuration process for the

first medical examination item according to the present
embodiment;

FIG. 7 is a flow chart showing the operation of the
configuration process for the second medical examination item of
5 the appointment process according to the present embodiment;

FIG. 8 is a diagram showing the situation of receiving each
of the medical examination items in accordance with guidance
information while carrying a wireless display device 1131 of FIG.
1 when visiting the actual site 1 of the medical examination
10 shown in FIG. 1 after the patient idn carries out the appointment
process;

FIG. 9 is a block diagram showing one example of the
wireless display device 113;

FIG. 10 is a diagram showing the situation of managing the
15 arrival or the departure of the patients by PC 12A1 to 12D1 that
has a wireless function installed for each of the medical
examination items 12A to 12D through the communication with the
wireless display devices 113 carried by the patients; and

FIG. 11 is a diagram showing a screen for confirming the
20 progress of the medical examination while staying at a work
office 2 of each home or a farmer which is in places away from
the site 1 of the medical examination as shown in FIG. 1 by
connecting to the server 11 from the PC 21, 22 and 23 installed

in the work office or a PC 31 or 32 installed at the home of the farmer via a network.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

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In the following, an embodiment of the present invention is described in reference to the drawings. First, a conceptual diagram of the entire configuration of a medical examination system according to the present embodiment is described in reference to FIG. 1 so that the entire system can be grasped. In FIG. 1 the entire site of a medical examination is denoted as 1, a server is denoted as 11, medical examination items are denoted as 12A to 12D and personal computers (hereinafter referred to as PCs) that have wireless interfaces installed at the site of each of the medical examination items are denoted as 12A1 to 12D1. The server 11 has a scheduler 111 that includes a waiting queue means 114 for individual medical examination items and a waiting queue means 115 for individual patients and the function of a wireless communication means. A plurality of virtual reality displays that form guidance information for receiving the medical examination which mainly include the appointment contents of the scheduler 111 are denoted as 112 and portable-type wireless display devices corresponding to virtual realty displays are

denoted as 113. The patients go around the medical examination site carrying a wireless display device 1131 or 1132, respectively.

Here, in FIG. 1, an office room located in a place away from the site 1 of the medical examination is denoted as 2 where PCs 21, 22 and 23 are personal computers installed within the office room 2. Those PCs 21, 22 and 23 are connected with the server 11 installed at the site 1 of the medical examination via a network so as to have a configuration where the progress of the medical examination can be confirmed or an appointment can be made while staying in the office room 2.

In FIG. 1, in the case that the medical examination is carried out where the site 1 thereof is installed at a local public office, or the like, each home of a farmer is denoted as 3 and PCs installed in each home 3 are denoted as 31 and 32. The PCs 31 and 32 are connected with the server 11 installed at the site 1 of the medical examination via a network so that the progress of the medical examination can be confirmed and an appointment can be made while staying at home in the same manner as above.

Next, the configuration of a scheduler of the present embodiment is described in detail. FIG. 2 shows a detailed configuration example of a waiting queue means 114 for individual

vertical lines.

FIG. 3 shows a detailed configuration example in the case that the scheduler 111 shown in FIG. 1 makes an appointment by utilizing the waiting queue means 115 for individual patients and the waiting queue means 114 for individual medical examination items. In FIG. 3 idn represents a new patient who makes an appointment for a medical examination at this time. The scheduler manages the waiting line queue so that a patient can receive the medical examination in the order starting from the earliest of the times T_{wa} to T_{wd} ($T_{wc} < T_{wd} < T_{wb} < T_{wa}$) which are possible available for appointment for each medical examination item of the waiting queue 114Q for the medical examination items 12A to 12D shown in FIG. 2. In addition, in FIG. 3 time for the first medical examination appointment item 12C is calculated from the time T_{wc} when the next appointment can be made and the times of the second and subsequent medical examination items are sequentially confirmed by updating times (T_{wd} , T_{wb} , T_{wa}) at which the next appointment can be made under the condition of completion time T_{com} of the medical examination item of the previously confirmed stage and by starting from the medical examination item of the earliest time. In FIG. 3, "max" shows a time that is the later of the two inputs while "min" shows a time that is the earlier of the two inputs. The

conditions of the completion time T_{com} , and later, of the medical examination item of the previous stage at and after the second item are made to be "matched" in the case that where an appointment is possible. In the case of a match, the appointment is completed where the queue for individual medical examination items is confirmed by means of the queue means 114. Or, in the case that there is not a match, rearrangement is again carried out with a return arrow and the process is repeated until an appointment becomes possible.

In addition, in FIG. 3 in the case that the time confirmed by the appointment process at and after the second item is delayed by the appointment time of the final patient in the original waiting queue for individual medical examination items for integral multiples, or more, of the average medical examination time (T_d , T_b , T_a) per patient of each of the medical examination items (12D, 12B, 12A) shown in FIG. 2, one, or a plurality of, empty ids are inserted when an appointment that does not specify a patient of an average medical examination time between, respectively, a waiting time and the starting time of each of the medical examination items (12D, 12B, 12A) is an empty id. This process is shown as "<e-id insertion>." When an appointment for idn at this time is completed, the update of the times T_{wa} to T_{wd} when the next appointment of the waiting queue

means 114 is available, including the inserted empty id, is carried out.

FIG. 4 shows an appointment condition of the waiting queue 114Q for individual medical examination items shown in FIG. 2 after an appointment is made for a patient idn by the scheduler 111 shown in FIG. 3.

In the appointment process of the patient idn of FIG. 4, since in the original waiting queue 114Q shown in FIG. 2, the sequential order of the time Twa to Twd when the next appointment can be made after each of the medical examination items 12A to 12D is $Twc < Twd < Twb < Twa$, the first item is confirmed as the medical examination item 12C. Even under the condition after the medical examination completion time of the confirmed medical examination items 12C, the order of the times when the next appointment is available does not change and is the order of $Twd < Twb < Twa$. Therefore, the second item of the medical examination is confirmed as 12D. The time when the next appointment is possible under the condition after the medical examination completion time of the confirmed medical examination item 12D is the time after the completion time of the final patient id5 of the medical examination item 12B and, therefore, becomes the completion time of 12D and the medical examination item 12A does not have a change and becomes $Twb < Twa$ so that the

medical examination item is confirmed as 12B at the changed time.
The final 12A becomes the final time of the medical examination
item 12B since as for the time when an appointment is possible
under the condition after the medical examination completion time
5 of the confirmed 12B, T_{wb} is the time at, and after, the
completion time of the final patient id7 and this value is
confirmed.

In FIG. 4, as for the process corresponding to "<e-id
insertion>" shown in FIG. 3, the time when only the medical
examination item 12B confirms an appointment for the patient idn
is delayed by the completion time of the final patient id5 of the
queue of the medical examination item 12B by an integer times, or
more, of the average medical examination time T_b per patient and,
therefore, in this case the situation is shown where one empty id
is inserted. Additionally in FIG. 4, when the confirmation of
the appointment time and "<e-id insertion>" are completed, the
time of each of the medical examination items when the next
appointment is available is updated to the time shown immediately
after the position of the vertical line indicated by an arrow of
20 the queue of each of the medical examination items 12A to 12D.
This time of the medical examination item 12B of FIG. 4 indicates
the starting time of the empty id newly inserted in this time
appointment process shown in FIG. 3 and represents the time

immediately after the completion time of the final patient in other medical examination items (12A, 12C, 12D).

In the case that the queue 114Q set in the waiting queue means 114 is in the condition shown in FIG. 4, the first medical examination item is confirmed to be the medical examination item 12C of which the time when the next appointment is available is the earliest in the next implemented medical examination appointment process. When the time that the next appointment is available is updated under the condition after the completion time of this confirmed time, only the empty id of 12B causes the overlap of the medical examination time and, therefore, only 12B is updated to the time immediately after the completion time of the final patient so that the medical examination appointment order becomes 12D, 12B, and 12A. This empty id of 12B is utilized again for the next appointment.

FIGS. 6 and 7 show flow charts of the case where a medical examination appointment process for a new patient (idn) is carried out by the scheduler 111 shown in FIG. 3 by utilizing the waiting queue 114Q for individual medical examination items shown in FIGS. 2 or 4 and the waiting queue 115Q for individual patients shown in FIG. 3. FIG. 6 shows the initial process and confirmation process for the first medical examination item while FIG. 7 shows the loop of the confirmation process of the second

and later medical examination items.

In Step S1 of FIG. 6, first, the record of the new patient (idn) for whom this time appointment process is carried out is formed and added to the waiting queue 115Q for individual patients. Then, in Step S2 the waiting queue 114Q for individual medical examination items stored in a file format, or the like, at the appointment starting point as shown in FIG. 3 is inputted so as to be developed in the memory, or the like, and to carry out the preparation for the appointment process of this time.

In Step S3, in order to carry out a confirmation process for the first medical examination item, the medical examination item of which the starting time is the earliest from among the times (Twa to Twd) when the next appointment is available is decided by the comparison process between the times (Twa to Twd) for which the next appointment is available with respect to the entirety of the medical examination items (12A to 12D) of the waiting queue 114Q as shown in FIG. 2. In the waiting queue 114Q, the medical examination item 12C becomes the first medical examination appointment item and the time Twc when the next appointment is available becomes the appointment time.

In Step S4, a new patient id (idn) is registered with the time that is pointed out by the time (Twc) when the next appointment is possible after the confirmed medical examination

item queue (12C). The new queue into which the first medical examination item and the starting time and finishing time are inputted is linked to the record of the new patient (idn) of the waiting queue 115Q formed in the first initialization process.

5 Next, in Step S5, the update processing of the time (Twc) for which the next appointment is available after the confirmed medical examination item queue (12C) is carried out. Here, in the case that the patient id (idn) is registered with the medical examination item queue (12C) which has been confirmed as the first item, no empty id exists for the medical examination item (12C) and, therefore, an update process is carried out with the time (Twc) when the next appointment is available immediately after the final patient id (id4) in this medical examination item queue (12C).

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20 In FIG. 7, in the appointment process for the new patient (idn) of this time, the second and later medical examination items are confirmed. First, since there is a case where there is only one medical examination item, completion determination of the medical examination item is initially carried out in Step S6 and, in the case that all of the medical examination items have been confirmed, the appointment process is completed.

 Next, in Step S7, in order to carry out the confirmation process for the second medical examination item, the medical

The time Twd for which the next appointment is possible of the medical examination item 12D matches the appointment time (Twc) wherein the first medical examination appointment item 12C is confirmed and, therefore, the procedure advances to the
5 confirmation process.

Here, in the case that it is not determined to be "matched", the process for returning to the candidate detection process is again carried out after the time for which the next appointment is available with respect to each of the entirety of the unconfirmed medical examination items is temporarily changed by adding the condition after the completion time of the appointment time confirmed at the previous stage in Step S9. The second medical examination item in the waiting queue 114Q shown in FIG. 2 is confirmed at 12D. In the case that the medical examination item for which the starting time is the earliest from among the times (Twa, Twb) for which the next appointment is available with respect to each of the unconfirmed medical examination items (12A, 12B) is made to be the third medical examination appointment item, it is not determined to be "matched" when the
20 time Twb for which the next appointment is available of the medical examination item 12B is made to be a appointment time candidate. Therefore, the temporary update processing of the times (Twa, Twb) for which the next appointment is available is

carried out resulting in Twb being shifted back one medical examination time.

On the other hand, in the case of the determination of "matched" in Step S10, confirming the medical examination item and medical examination appointment time carries out the registration process. This process is the same as the registration process of the first medical examination item shown in FIG. 6 wherein a new patient id (idn) is registered with the time pointed out by the time for which the next appointment is available for the confirmed medical examination item queue is registered and a new queue into which the second and later medical examination items and their starting times and completion times are inputted is linked with the record of the new patient (idn) of the waiting queue 115Q for individual patients formed at the first initialization process.

In the case that the time for which the next appointment is available has not been determined to be "matched" so as to be temporarily changed, and the time for which the next appointment is available is utilized, a physically vacant time is generated between the completion time of the appointment of the final patient in the original medical examination item queue and the time for which the next appointment is available. In order to effectively utilize this vacant time, it is determined whether or

not the vacant time has the interval of an integer times, or
more, of the average medical examination time of the medical
examination item in Step S11. In the case that there is such an
interval, an insertion process of the empty id is carried out in
5 Step S12. The third medical examination appointment item, only,
is not determined to be "matched" in the waiting queue 114Q shown
in FIG. 2, only in the case that the time Twb for which the next
appointment is available of medical examination item 12B is made
to be an appointment time candidate. Therefore, a temporary
10 update process of the time (Twa, Twb) for which next appointment
is available is carried out. Consequently, since Twb has been
shifted back one medical examination time unit, the determination
process where the insertion of the empty id is unnecessary
becomes NG and the insertion process of one empty id becomes
15 necessary only for the medical examination item 12B.

Then, finally, an update process of the time for which the
next appointment is available corresponding to the nth (n is an
integer of 2 or larger) medical examination item queue which is
confirmed in Step S13 is carried out. Here, since one empty id
20 exists in the medical examination item queue (12B) with which the
patient id (idn) is registered only in the medical examination
item queue (12B) confirmed as the third item, an empty id
immediately after the patient id5 is allocated for the time (Twb)

of which the next appointment is available for this medical examination item queue (12B). In addition, in the figure, in order to carry out an appointment process for the entirety of the medical examination items, after the completion determination of the leading medical examination item is carried out and the procedure is looped until the entirety of the medical examination items have been confirmed.

FIG. 5 illustrates the situation where isolated empty ids are replaced with void ids which cannot be utilized again so as to shorten the medical examination time by suppressing the effects thereof so that no patient who has made an appointment has a long medical examination time due to the occurrence of isolated empty ids because of the dispersion of the time intervals of the average medical examination time T_a to T_d of the medical examination items 12A to 12D shown in FIG. 2.

Now, in the case that the lead of the time for which the appointment is available is an isolated empty id for each patient, the maximum medical examination time is assumed to be set in advance at, for example, T_0 , or less. In FIG. 5 there is an isolated empty id at the second item of the queue of the medical examination item 12C and the time T_{wc} for which the next appointment is available indicates the time of this leading empty id and the times T_{wd} , T_{wb} , T_{wa} for which the next appointments

T2 is the constant medical examination time T0, or less, and the first medical examination item 12D is not an empty id, the entire appointment process is confirmed in this route (2) from these two.

5 Next, cancellation by the scheduler is described. When there is an application of cancellation of the medical examination appointment, in the case that there is not confirmation of the patient a constant time before the appointment time of the first medical examination item of the waiting queue for individual patients corresponding to the patient or in the case that there is an application for cancellation by the patient before that, then the waiting queue for individual patients for this patient is eliminated. Then, all of the patients who are queued in the waiting queue means 114 for individual medical examination items are moved to an empty queue so that reappointments for this time become possible. In addition, cancellation notices are given to the patients who have not yet made appointments and appointment change notices are given to the patients who have already made appointments.

20 FIG. 8 shows the situation where, after the patient idn shown in FIG. 3 performs the appointment process, the patient visits the actual site 1 of the medical examination at the appointment time, carries the wireless display device 1131 of

FIG. 1 and receives each of the medical examination items in accordance with guidance information.

In FIG. 8 when the idn, which is an id of the patient, is registered at the reception, a wireless display device 1131 is delivered. FIG. 9 is a block diagram showing an example of the wireless display device. The wireless display device 113 is configured by including a communication unit 120, a CPU 121, a frame memory 122 and a display unit 123 such as of liquid crystal, or the like, an input unit 124, such as a touch panel, and a memory 125. The wireless display device 113 communicates with the server 11 and with the PCs 12A1 to 12D1 that are deposited in the vicinity of the medical examination items and displays a guide screen on the display unit 123. The PCs 12A1 to 12D1 also have communication means for communicating with the wireless display device 113 and the server 11 and the control means for outputting the completion of the medical examination of the patients.

Now, when a patient receives a wireless display device 1131, the wireless display device 1131 reads out the medical examination appointment contents of the corresponding idn of the waiting queue 115Q of the scheduler means 111 which have been registered at the reception and forms medical examination guidance information that indicates the route, the starting and

finishing time and a map of the premises on one of the virtual
realty displays 112. Then, the data are transmitted to the
corresponding wireless display device 1131 so as to displayed and
the guidance information is updated whenever a medical
5 examination item is completed.

FIG. 10 shows the situation where the PCs 12A1 to 12D1 that
are installed in the positions for each of the medical
examination items 12A to 12D and which have a wireless function
and a wireless display device 113 carried by a patient
communicate regarding the arrival of a patient or the departure
of a patient at the time of the completion of the medical
examination.

In FIG. 10 the PCs 12A1 to 12D1 have two communication
modes, the function of communicating with a wireless display
device 113 only in the area around the entrance and the exit of
the medical examination site with directionality for short
distances and the function of communicating with the server 11.
The PCs 12A1 to 12D1 download, from the server 11, and manage the
waiting queue for individual patients of all of the patients who
20 are present in the waiting queue for individual medical
examination items and are present at the medical examination site
1. Accordingly, all of the patients who can arrive at the
medical examination site from among the patients who have

registered the ids at the reception are surveyed in a wireless manner and, when a response is returned from a wireless display device 113, an arrival notice is given to the server 11 so that an arrival icon is transmitted from the server 11 as a notice to the patient.

FIG. 11 shows a screen for confirming the status of progress of the medical examination, without patients leaving, through the connection from the PCs 21, 22, 23 installed in an office room 2 of a work office in a place apart from the medical examination site 1 as shown in FIG. 1 or the PCs 31, 32 installed at respective homes 3 of farmers to the server 11 via the network.

In FIG. 11, the status of progress shows the patients who are undergoing medical examination and the medical examination appointment list remaining in the waiting queue means 115 for individual medical examination items of the server 11 shown in FIG. 1. In the case that the patients who are confirming the status of progress have already made an appointment, their own appointment queue is reversed so as to display the appointment times for individual medical examination items 12A to 12D of the patients. In the case that the patients who are confirming the status of progress have not yet made an appointment, the times Twa to Twd for which the next appointments are available of the

waiting queue means 114, which include conventional empty ids,
are represented. The lower portion of FIG. 11 shows the
situation where the total number of patients N_t who are to
receive a medical examination on that day, the number of patients
5 N_c who have already completed the medical examination and have
been eliminated from the waiting queue means 114, the number of
patients N_p who are at present undergoing medical examination and
who are marked, the number of patients N_{ap} who have already made
an appointment and the number of patients N_{nap} who have not yet
made an appointment are displayed.

As described in detail above, according to the medical
examination system of the present application, which has a simple
configuration and portability, in the case of an on-site medical
examination with the presupposition that the patients undergo
medical examination during working hours, an appointment can be
made for an individual medical examination in a manner where the
entire medical examination time becomes of the minimum grasping
the status of progress of the medical examination of an office
room or workplace where work is carried out. In addition, even
20 in the case that the places, layout and the order for the medical
examination have changed due to the installation conditions,
guidance for the necessary medical examination order and for the
medical examination place can be carried out based on the

appointment conditions for individual patients by means of a wireless display device at the medical examination site.

Accordingly, it becomes possible to provide a medical examination system wherein amount of time of interruption of work by the
5 medical examination can be kept to a minimum and patients can undergo medical examination without becoming confused concerning the route of a medical examination at an unfamiliar site.

It is to be understood that although the present invention has been described with regard to preferred embodiments thereof, various other embodiments and variants may occur to those skilled in the art, which are within the scope and spirit of the invention, and such other embodiments and variants are intended to be covered by the following claims.

The text of Japanese priority application no. 2001-112387 filed April 11, 2001 is hereby incorporated by reference.